REMARKS/ARGUMENTS

Claims 1-13, 18-26 and amended claims 14-17 are pending in this application. Claims 1-26 stand rejected and claims 14-17 also stand objected to. Applicants reserve the right to pursue the original claims and other claims in this application and in other applications.

Claims 14-17 are objected to based on informalities. Claims 14-17 have been rewritten to overcome the informality and expedite the prosecution of this case. No new matter has been added.

Claims 1-15 and 18-21 stand rejected under 35 U.S.C. § 103(a) as being obvious over North (U.S. Patent No. 6,081,558). Reconsideration is respectfully requested.

Claim 1 recites, inter alia, a method comprising: "changing the gain of an amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor; and changing the power consumption of the amplifier in the gain stage in response to changing the gain."

North discloses a method and apparatus for operating an optical communications receiver at low power during periods when no optical transmission activity is present. North fails to disclose or suggest 'changing the gain of an amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor' or 'changing the power consumption of the amplifier in the gain stage in a sensor in response to changing the gain.' As indicated in the Office Action, North does not teach a pixel array and therefore has no teachings which are relevant to operation of such an array. Particularly, North does not teach or suggest a gain adjusted system responsive to pixel output signals and also fails to teach changing power consumption in response to a change in gain.

The Office Action asserts that it is well-known in the art to use a pixel array to capture two dimensional data for imaging, and that it would therefore have been obvious to one with ordinary skill in the art to use the North teaching on pixel data from a pixel array. Applicant respectfully disagrees. As noted in the specification, pixel signals may be too low to fall in a range of an analog to digital converters and therefore gain adjustment is made in response to the pixel signals of a pixel array. The invention also changes power consumption in response to a change in gain. North deals with gain control of a received optical signal, but has no teachings to suggest that the disclosed gain control could be used in response to pixel signals generated by a pixel array. North also does not disclose, in any event, a change in power consumption in response to a change in gain. As shown, for example, in Fig. 4, the invention first changes the gain applied to pixel signals and then changes power consumption in response to the change in gain. This is nowhere suggested in North. Accordingly, withdrawal of the rejection of claim 1 is respectfully requested.

Claims 2-7 depend from claim 1, and incorporate, directly and indirectly, all the limitations thereof, and likewise the distinction that the use of North's methods and apparatus are not obvious when applied to pixel arrays.

Claim 2 depends from claim 1 and includes the additional limitation not disclosed or suggested by North that changing the power consumption comprises changing a transconductance of an input transistor in the amplifier.

Claim 3 depends from claim 1 and includes the additional limitation not disclosed or suggested by North that the power consumption comprises decreasing the power consumption in response to a decrease in the gain and increasing the power consumption in response to an increase in the gain.

Claim 4 depends from claim 1 and includes the additional limitations not disclosed or suggested by North of associating a plurality of consumption settings with a plurality of gain settings and selecting a gain setting from said plurality of gain settings, and selecting a power consumption setting associated with the selected gain setting.

Claim 5 depends from claim 4 and includes the additional limitation not disclosed or suggested by North that the gain setting is selected from eight gain settings.

Claim 6 depends from claim 5 and includes the additional limitation not disclosed or suggested by North that the power consumption setting is selected from three power consumption settings, each of three power consumption setting being associated with a different plurality of gain settings.

Claim 7 depends from claim 4 and includes the additional limitation not disclosed or suggested by North that each of the plurality of gain settings is associated with a different one of the plurality of power consumption settings.

Accordingly, withdrawal of the rejection of claims 2-7 is respectfully requested for at least the reasons argued above.

Claim 8 recites, inter alia, a method comprising: "selecting one of a plurality of gain settings in response to a signal read out from a pixel array in a sensor; generating two or more bias currents having bias current values associated with the selected gain setting; and applying said two or more bias currents to a plurality of parallel transistors in an amplifier in a gain stage of the sensor in order to change the input transconductance of the amplifier."

North discloses a method and apparatus for operating an optical communications receiver at low power during periods when no optical transmission activity is present. North fails to disclose or suggest 'selecting one of a plurality of gain settings in response to a signal read out from a pixel array in a sensor' or 'generating two or more bias currents having bias current values associated with the selected gain setting' or 'applying said two or more bias currents to a plurality of parallel transistors in an amplifier in a gain stage of a sensor in order to change the input transconductance of the amplifier.' As indicated in the Office Action, North does not teach a the sensor element as a pixel array and therefore has no teachings which are relevant to operation of such an array. Particularly, North does not teach or suggest a gain adjusted system responsive to pixel

output signals; generating current values in response to the selected gain; and changing the input transconductance of the amplifier in response to the change in gain.

The Office Action asserts that it is well-known in the art to use a pixel array to capture two dimensional data for imaging, and that it would therefore have been obvious to one with ordinary skill in the art to use the North teaching on pixel data from a pixel array. Applicant respectfully disagrees. As noted in the specification, pixel signals may be too low to fall in a range of an analog to digital converters and therefore gain adjustment is made in response to the pixel signals of a pixel array. The invention also changes bias current in response to a change in gain. North deals with gain control of a received optical signal, but has no teachings to suggest that the disclosed gain control could be used in response to pixel signals generated by a pixel array. North also does not disclose, in any event, a change in bias current in response to a change in gain. As shown, for example, in Fig. 4, the invention first changes the gain applied to pixel signals and then changes bias current in response to the change in gain. This is nowhere suggested in North. Accordingly, withdrawal of the rejection of claim 8 is respectfully requested.

Claims 9-10 depend from claim 8, and incorporate, directly and indirectly, all the limitations thereof, and likewise the distinction that the use of North's methods and apparatus are not obvious when applied to pixel arrays.

Claim 9 depends from claim 8 and includes the additional limitation not disclosed or suggested by North that associated each of a plurality of input transconductance settings to a plurality of gain settings, each input transconductance setting being associated with a given set of bias current values.

Claim 10 depends from claim 8 and includes the additional limitation not disclosed or suggested by North of associating an input transconductance settings to each of a plurality of gain settings, each input transconductance setting being associated with a given set of bias current values.

Accordingly, withdrawal of the rejection of claims 9-10 is respectfully requested

for at least the reasons argued above.

Claim 11 recites, inter alia, an apparatus comprising: "a gain stage for a sensor, said gain stage having a differential amplifier including a gain selector operative to select one of a plurality of gain settings in response to a signal from a pixel array, an input transistor having a variable input transconductance, and a transconductance controller operative to select an input transconductance of the input transistor in response to a selected gain setting."

North discloses a method and apparatus for operating an optical communications receiver at low power during periods when no optical transmission activity is present. North fails to disclose or suggest 'a gain stage for a sensor, said gain stage having a differential amplifier including a gain selector operative to select one of a plurality of gain settings in response to a signal from a pixel array.' Neither does North disclose or suggest 'an input transistor of a sensor having a variable input transconductance' nor a 'transconductance controller of a sensor operative to select an input transconductance of the input transistor in response to a selected gain setting.' As indicated in the Office Action, North does not teach a the sensor element as a pixel array and therefore has no teachings which are relevant to operation of such an array.

The Office Action asserts that it is well-known in the art to use a pixel array to capture two dimensional data for imaging, and that it would therefore have been obvious to one with ordinary skill in the art to use the North teaching on pixel data from a pixel array. Applicant respectfully disagrees. As noted in the specification, pixel signals may be too low to fall in a range of an analog to digital converters and therefore gain adjustment is made in response to the pixel signals of a pixel array. The invention also changes input transconductance in response to a change in gain. North deals with gain control of a received optical signal, but has no teachings to suggest that the disclosed gain control could be used in response to pixel signals generated by a pixel array. North also does not disclose, in any event, a change in input transconductance in response to a change in gain. Accordingly, withdrawal of the rejection of claim 11 is respectfully requested.

Claims 12-15 depend from claim 11, and incorporate, directly and indirectly, all the limitations thereof, and likewise the distinction that the use of North's methods and apparatus are not obvious when applied to pixel arrays.

Claim 12 depends from claim 11 and includes the additional limitation not disclosed or suggested by North that the transconductance controller is operative to select an input transconductance setting associated with the selected gain setting from a plurality of input transconductance settings.

Claim 13 depends from claim 11 and includes the additional limitation not disclosed or suggested by North that the input transistor comprises a first plurality of parallel transistors connected to a first bias current supply and a second plurality of parallel transistors connected to a second bias current supply.

Claim 14 depends from claim 13 and includes the additional limitation not disclosed or suggested by North that the transconductance controller comprises a bias current selector operative to select values for first bias current and a second bias current associated with a selected gain setting, and a bias current generator operative to generate a first current having the selected value for the first bias current value and apply said first current to the first bias current supply and to generate a second current having the selected value for the second bias current value and apply second current to the second bias current supply.

Claim 15 depends from claim 14 and includes the additional limitation not disclosed or suggested by North that each first and second bias current values produces a different input transconductance.

Accordingly, withdrawal of the rejection of claims 12-15 is respectfully requested for at least the reasons argued above.

Claim 18 recites, inter alia, a sensor comprising: "a pixel array comprising a plurality of pixels arranged in rows and columns; a read-out section operative to read out

signals generated by pixels in the pixel array; a gain stage having a differential amplifier including a gain selector operative to set the differential amplifier to one of a plurality of gain settings in response to a pixel signal read out from the pixel array, an input transistor having an input transconductance and including a first plurality of parallel transistors connected to a first bias current supply and a second plurality of parallel transistors connected to a second bias current supply, and a transconductance controller operative to change the transconductance of the input transistor to match a selected gain setting by selectively applying different bias currents to at least one of said first and second bias current supplies for different gain settings."

North discloses a method and apparatus for operating an optical communications receiver at low power during periods when no optical transmission activity is present. North fails to disclose or suggest 'a gain stage of a sensor having a differential amplifier including a gain selector operative to set the differential amplifier to one of a plurality of gain settings in response to a pixel signal read out from the pixel array.' Neither does North disclose or suggest 'an input transistor of a pixel array having an input transconductance and including a first plurality of parallel transistors connected to a first bias current supply and a second plurality of parallel transistors connected to a second bias current supply.' Nor does North disclose or suggest 'a transconductance controller of a pixel array operative to change the transconductance of the input transistor to match a selected gain setting by selectively applying different bias currents to at least one of said first and second bias current supplies for different gain settings.' As indicated in the Office Action, North does not teach a the sensor element as a pixel array or active pixel sensor, or the amplifier as a differential amplifier and therefore has no teachings which are relevant to operation of such an array. Particularly, North does not teach or suggest a gain adjusted system responsive to pixel output signals and also fails to teach changing transconductance of a input transistor in response to a change in gain.

The Office Action asserts that it is well-known in the art to use a pixel array to capture two dimensional data for imaging, to use active pixels to provide a greater intensity detection signal and to use a differential amplifier to provide a different zero level for the

input and that it would therefore have been obvious to one with ordinary skill in the art to use the North teaching on pixel data from a pixel array. Applicant respectfully disagrees. As noted in the specification, pixel signals may be too low to fall in a range of an analog to digital converters and therefore gain adjustment is made in response to the pixel signals of a pixel array. The invention also changes transconductance of a input transistor in response to a change in gain. North deals with gain control of a received optical signal, but has no teachings to suggest that the disclosed gain control could be used in response to pixel signals generated by a pixel array. North also does not disclose, in any event, a change in transconductance of a input transistor in response to a change in gain. Accordingly, withdrawal of the rejection of claim 18 is respectfully requested.

Claims 19-21 depend from claim 18, and incorporate, directly and indirectly, all the limitations thereof, and likewise the distinction that the use of North's methods and apparatus are not obvious when applied to pixel arrays.

Claim 19 depends from claim 18 and includes the additional limitations not disclosed or suggested by North that the transconductance controller comprises a gain decoder operative to select one or more bias current values in response to a selected gain response from a plurality of bias current values and a bias generator operative to generate and apply said one or more bias current values to at least one of the first and second bias current supplies.

Claim 20 depends from claim 18 and includes the additional limitation not disclosed or suggested by North that the transconductance controller is operative to increase the transconductance of the input transistor in response to an increase in the gain of the differential amplifier and to decrease the transconductance of the input transistor in response to a decrease in the gain of the differential amplifier.

Claim 21 depends from claim 18 and includes the additional limitation not disclosed or suggested by North that the sensor is an active pixel sensor.

Accordingly, withdrawal of the rejection of claims 19-21 is respectfully requested

for at least the reasons argued above.

Claims 16-17 stand rejected under 35 U.S.C. § 103(a) as being obvious over North in view of Kozlowski (U.S. Patent No. 5,892,540). Reconsideration is respectfully requested.

Claims 16-17 depend from claim 11 and are allowable at least for the reasons argued above. Additionally, Kozlowski discloses a system for managing low noise readout in an imager having passive pixels and includes a variable capacitance amplifier. Kozlowski fails to disclose or suggest 'a gain stage for a sensor, said gain stage having a differential amplifier including a gain selector operative to select one of a plurality of gain settings in response to a signal from a pixel array,' 'an input transistor of a sensor having a variable input transconductance,' and a 'transconductance controller of a sensor operative to select an input transconductance of the input transistor in response to a selected gain setting.' The Office Action asserts that it would have been obvious to one of ordinary skill in the art to use the switches of Kozlowski in the apparatus of North, to provide a simple, cost effective method of dynamically modifying the gain for a feedback amplifier. As argued above, there is no motivation to applying the teachings of the North invention to address adjusting amplifier power consumption in a sensor having a pixel array. Accordingly, withdrawal of the rejection of claims 16-17 is respectfully requested.

Claims 22-26 stand rejected under 35 U.S.C. § 103(a) as being obvious over North in view of Williams (U.S. Patent No. 5,864,416). Reconsideration is respectfully requested.

Claim 22 recites, <u>inter alia</u>, a method comprising "changing the gain of an amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor; and changing a gain bandwidth (GBW) of the amplifier in the gain stage in response to changing the gain."

North discloses a method and apparatus for operating an optical communications receiver at low power during periods when no optical transmission activity

is present. Williams discloses a tunable, multi-octave optical communications receiver. Neither Williams nor North disclose 'changing the gain of an amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor' or 'changing a gain bandwidth (GBW) of the amplifier in the gain stage of a sensor in response to changing the gain.' As indicated in the Office Action, neither North nor Williams teaches a the sensor element as a pixel array and therefore has no teachings which are relevant to operation of such an array. Particularly, neither North nor Williams teach or suggest a gain adjusted system responsive to pixel output signals and also fails to teach changing gain bandwidth in response to a change in gain.

The Office Action asserts that it is well-known in the art to use a pixel array to capture two-dimensional data for imaging, and to recalibrate the required bandwidth after changing a gain, to optimize amplification frequencies and to use a pixel array and respond to a gain change in the method of Williams, to capture multi-dimensional data for imaging purposes. Further that it would therefore have been obvious to one with ordinary skill in the art to use the North teaching on pixel data from a pixel array. Applicant respectfully disagrees. As noted in the specification, pixel signals may be too low to fall in a range of an analog to digital converters and therefore gain adjustment is made in response to the pixel signals of a pixel array. The invention also changes power consumption and gain bandwidth in response to a change in gain. North deals with gain control of a received optical signal, but has no teachings to suggest that the disclosed gain control could be used in response to pixel signals generated by a pixel array. North also does not disclose, in any event, a change in power consumption or gain bandwidth in response to a change in gain. Accordingly, withdrawal of the rejection of claim 22 is respectfully requested.

Claims 23-26 depend from claim 22, and incorporate, directly and indirectly, all the limitations thereof, and likewise the distinction that the use of North's and William's methods and apparatus are not obvious when applied to pixel arrays.

Claim 23 depends from claim 22 and includes the additional limitation not disclosed or suggested by North or Williams that changing the GBW comprises changing a

transconductance of an input transistor in the amplifier.

Claim 24 depends from claim 23 and includes the additional limitation not disclosed or suggested by North or Williams that changing the GBW comprises decreasing the GBW in response to an decrease in the gain, and increasing the GBW in response to an increase in the gain.

Claim 25 depends from claim 22 and includes the additional limitation not disclosed or suggested by North or Williams that changing the root mean square noise at an output of the amplifier in response to changing the GBW.

Claim 26 depends from claim 25 and includes the additional limitation not disclosed or suggested by North or Williams that changing the RMS noise comprises decreasing the RMS noise in response to an decrease in the GBW, and increasing the RMS noise in response to an increase in the GBW.

Accordingly, withdrawal of the rejection of claims 23-26 is respectfully requested for at least the reasons argued above.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

Dated: March 11, 2003

Respectfully submitted,

By

Thomas J. D'Amico
Registration No.: 28,371
Michael A. Weinstein
Registration No.:P 53,754
DICKSTEIN SHAPIRO MORIN &
OSHINSKY LLP
2101 L Street NW
Washington, DC 20037-1526
(202) 785-9700
Attorneys for Applicant

Version With Markings to Show Changes Made

14. (Amended) The apparatus of claim 13, wherein the transconductance controller comprises:

a bias current selector operative to select values for first bias current and a second bias current associated with a selected gain setting, and

a bias current generator operative to generate a first current having the selected value for the first bias current value and apply said first current to the first bias current supply and to generate a second current having the selected value for the second bias current value and apply second current to the second bias current supply.

15. (Amended) The apparatus of claim 14, wherein [each set of current values] each first and second bias current values produces a different input transconductance.

16. (Amended) The [gain stage] apparatus of claim 14, wherein the bias selector includes a plurality of switches and is operative to select a different set of switches for each of said plurality of gain settings.

17. (Amended) The [gain stage] apparatus of claim 16, wherein the bias current selector is operative to select a set of current values in response to the switches selected by the gain [decoder] selector.